The History and Developement of the Pratt Street Power Plant of the Baltimore Consolidated Gas Electric Light & Power Co.

SUMMARY.

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The deplorable condition of city transportation in Baltimore before 1899 came about due to competition among the many existing lines. On March 4, 1899 these independent companies joined hands and became the United Railways & Electric Company. To supply electrical energy for the street cars, the numerous small generating plants were dispersed and a large power plant was established on Pratt Street.

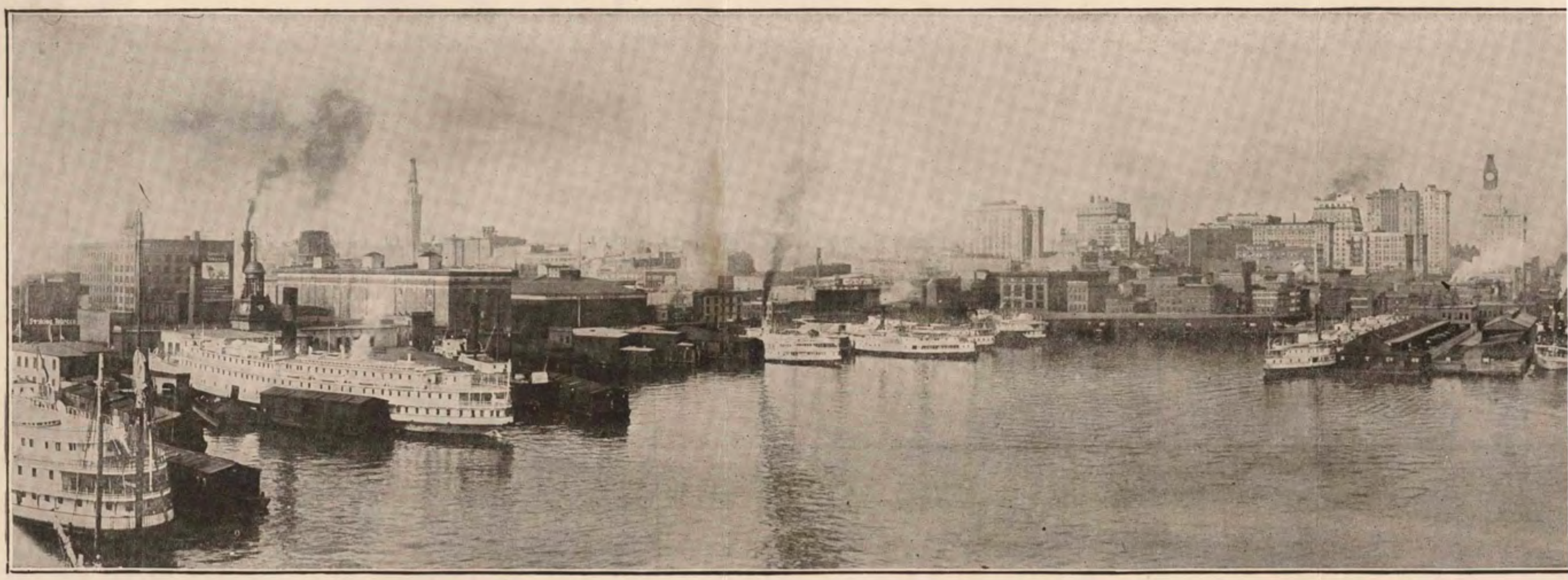
The Pratt Street Power Plant was brought to completion shortly after the Baltimore fire of 1904. As an engineering project it attracted much attention, because of a radical departure from general power practice. The station occupied a space 132' by 490' and consists of three buildings, known as Engine House No. 1, Boiler House, and Engine House No. 2 located in the order named from Pratt Street. The equipment included four engines of 3000 H. P. each, directly connected to generators of 2000 kilowatt capacity. The engines were driven by a battery of thirty-two boilers and the main engine room was equipped with an overhead electric crane, the largest in the world at that time.

Each year as the smaller plants were abandoned the Pratt Street Plant increased its capacity until in 1909 the capacity of the station was 39,000 kilowatts and the only other power plant in operation was at Bay Shore Park. In 1911 the United Railways & Electric Co. signed a contract for additional hydro-electric power from the Mc Call Ferry Plant of the Pennsylvania Water & Power Co. This amount being supplied by the Pennsylvania Co. was gradually increased until the Pratt Street Station was operated for emergency service at power failures of the Pennsylvania Co.

On January 12, 1921 the power equipment of the United Railways passed into the ownership of the Baltimore Consolidated Gas Electric Light & Power Co., an affiliate of the Pennyslvania Co., with the agreement that the Railways Co. would buy all of its power for the next fifty years from the Consolidated Co.

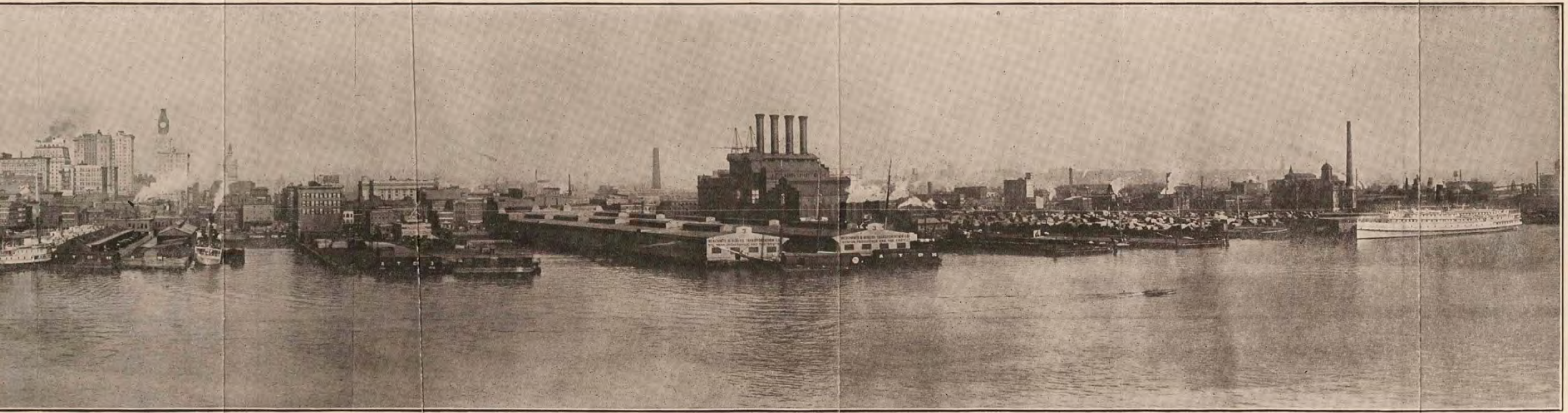
The Pratt Street Power Plant was used to handle the energy required for the United Railways and due to increased load conditions new equipment was found necessary. In 1926 a new switch house was built inside of the old Engine Room No.1 of the Pratt Street Plant. The old engines were removed and a large portion of the Engine Room remodelled and turned into a storage room. At the present time besides generating and handling electrical energy, the station also engages in the supplying of steam for heating purposes.

Although the Westport and the Gould Street Power Plants are superior to the Pratt Street Power Plant, it may be said that the Pratt Street Station is the heart of a great railway system. Through this station pulsates the very life blood of the trolley lines of Baltimore, the current that energizes the motors of a thousand cars.



A PORTION OF THE UPPER HA

A view of Baltimore taken from an old book clearly shows the large power plant located on Pratt Street. This building is the most prominent on the picture and is distinquished by four hugh stacks.



ION OF THE UPPER HARBOR SHOWING SOME OF THE MUNICIPAL PIERS

CENTRALIZATION OF POWER.

The grievous condition of city transportation in Baltimore before 1899 was the result of competition among the numerous transit companies then in existence. On March 4, 1899 these independent organizations were consolidated into the United Railways & Electric Company. This merger made possible the centralization of power equipment, and, therefore, the supplying of cars with electrical energy most economically. Losses in long cables when carrying direct current were reduced by using alternating current at high voltages, with the final conversion into direct current for the street cars at substations.

Since the United Railways & Electric Company was formed as a combination of many independent, self-supporting companies, it acquired numerous power plants in different parts of Baltimore, The wastefulness of continuing under such an arrangement soon became apparent. This was due to the fact that the combined capacities of the small plants was greater than the maximum load of all lines at any time. A much better arrangement being a single unit of enough capacity to supply the entire demand.

The United Railways & Electric Company then proceeded to build a central power station and to gradually do away with the numerous smaller plants. The erection of this generating station, known as the Pratt Street Power Plant, was the completion of an adequate and reliable electric car service in Baltimore.

ORIGINAL BUILDING AND EQUIPMENT.

One of the familiar sights along Baltimore's waterfront is the old Pratt Street Power Station, with its massive stacks and lofty conveyor towers. This structure was brought to completion, shortly after the Baltimore fire of 1904, by the United Railways & Electric Company as a main generating station for its motive power and to supplant the numerous smaller generating stations throughout the city. The Pratt Street Power House was built when the whole task of generating current for this city's railways was bourne by the systems power stations. It was the scene of constant activity, and its immense engines labored day and night unceasingly in manufacturing electricity which was served out to the many lines of street railways.

This power station is located on the South side of Pratt Street, on pier No. 4. The station occupies a space 132' by 490' and consists of three buildings, known as Engine House No. 1, Boiler House, and Engine House No. 2, located in the order named from Pratt Street. All three buildings rest on pilings, superimposed by a concrete mat varying in thickness from three to eight feet, not clear and are of standard steel framing enclosed by curtain walls of red brick with terra-cotta trimmings. These buildings are of fire proof construction throughout, the roofs being of slag or slate, the floors of reinforced concrete, and all windows, doors and trim of steel or hollow metal construction.

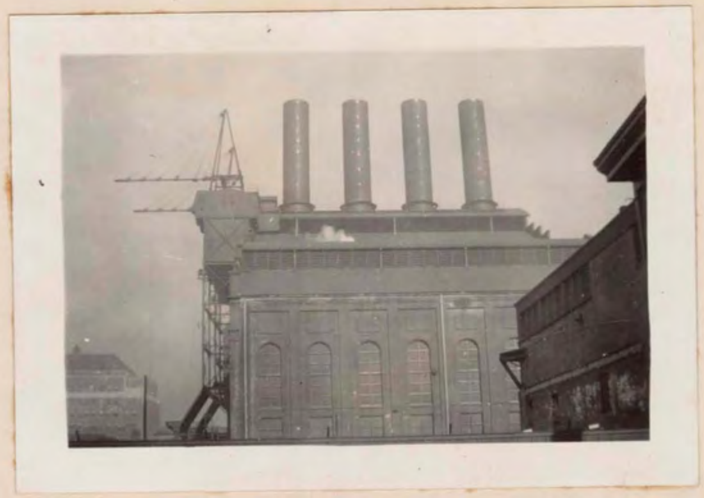
All main generating units were operating condensing. The condensing water was taken from the slip on the west side of the station. A complete system of concrete intake and discharge wells was provided for this purpose. The condensers of all engine driven

units were of the Worthington Barometric type, while the circulating outfits, with the exception of the five 2000 kilowatt units located in Engine House No.2,which were motor driven, were either turbo or engine driven. The 5000 kilowatt Curtis Turbine was fitted with a Worthington Jet Condenser, while the Westinghouse Parsons Turbine was fitted with two No. 18 Westinghouse Le Blanc condensers with turbo driven air and circulating pumps.

Excitation current was provided by one 150 kilowatt motor driven unit, one 150 kilowatt engine driven unit, one 200 kilowatt engine driven unit and one 300 kilowatt turbine driven unit.

Steam was supplied by thirty-two Babcock and Wilcox water tube boilers fitted with Roney stokers. The boilers were arranged so that there were sixteen located on each floor of the boiler house. The boiler house was fitted with four,steel, brick-lined, self-supporting stacks, eight boilers being connected to each stack by individual smoke flues. The stacks were each thirteen feet in diameter and one hundred and ninety-two feet high. Installed in each stack was a Schutte & Koerting blast nozzle to provide additional draft for emergency conditions.

Coal was delivered to the pier in scows and elevated a distance of one hundred and thirty feet by means of two Hunt electrically operated coal towers to the weighing platforms where the coal, after being crushed, was weighed and distributed to the storage bunkers by means of two Hunt gravity return railways. Mechanical sampling machinery, located on the weighing platform, automatically took a sample of each lot and delivered it to a pulverizing machine from whence it was fed into sampling cans in



A view of the plant showing the four huge stacks atop the Boiler House. The structure at the upper left consists of the conveyor system and the coal towers.

One of the conveyor cranes raising coal from a scow to the coal tower. As can be seen from the picture, the scow can be brought alongside the power plant.

the proper condition for analysis.

The storage bunkers were made of steel and concrete construction, each of 2000 tons capacity, located above the second floor of the boiler room. From the bunkers the coal was conveyed directly to the boilers by means of an elaborate system of coal chutes and spreaders.

The ashes were dumped from the ash hoppers under the boilers into two Hunt bucket conveyors. They were then elevated and dumped into concrete storage bins, located outside the boiler room on the coal tower structure, at a sufficient height to admit of the ashes being loaded directly into cars and hauled away.

Engine Room No.1 was provided with a fifty ton traveling bridge crane, and fitted with an auxiliary ten ton hoist. This crane was electrically operated and was the largest crane, of this type, in the world. Engine Room No. 2 was fitted with a thirty ton crane of the same type.

ELECTRIC CONTROL.

The switching control for the entire station was located in Engine Room No. 1, the direct current board being separated from that of the alternating current board. The alternating current switching gear was in a separate structure located in the northerly end of Engine Room No.1. The switching structure proper was twenty-five feet wide by eighty-five feet long, three stories and a basement in height, and was separated from the engine room proper by a brick wall. All feeders, both outgoing and incoming, ended in the basement, and their series transformers were located in compartments in the upgoing branches. The first floor held bus bars, feeder

oil switches and leads from alternators with their series transformers. On the second floor were located the alternator bus bars and oil switches, while the third floor was devoted to the switching and control boards in the operation of all high tension apparatus, as well as of the exciter, field and auxiliary systems. The fourth floor is used for office and storage battery room. A permanent grounding system was run throughout the switchboard structure, having receptacles at various points to recieve flexible leads for grounding transformer cases, switch bases, all buses, oil switch pots and feeder cables.

The alternating current high tension control bench was built in a semi-circular form and was in twenty-two sections. Black marine-finished slate was used for the panel work and was supported by structural steel framework. One section of the control bench was fitted with standard testing instruments. On every bench containing ammeters, voltmeters and other instruments there were plug receptacles connected to buses running to testing instruments so arranged that by means of plugs, any instrument could be connected to the standard instruments for comparison. The test instruments provided for were voltmeter, ammeter, power factor meter, indicating wattmeter, recording wattmeter and frequency meter.

The exciter switchboard was located on the control floor, opposite to and facing the curved benchboard. There were ten black marine-finished slate panels, provided with a full complement of apparatus especially arranged to control all exciter, field and lighting circuits. These circuits operated at 110 volts, as did also the alternating current instrument circuits, so that no current of

a higher potential than 110 volts was brought to the control floor.

The bus bar and oil switch structure was built of light-colored shale brick, with concrete slabs, poured as the structure was made.

A comprehensive system of pipes and ducts was installed for the reception of cables, the main feature of which was the complete isolation of each group of cables belonging to a machine unit and the installation of each cable in a separate conduit. Provision was also made in this structure for the receipt of current from the hydro-electric plant of the Pennsylvania Water & Power Co. located on the Susquehanna River at Holtwood Pa., a distance of approximately fo~~u~~rty miles from the city.

A high tension potential transformer, for testing purposes, was installed on the basement or cable floor, with its leads connected to bus bars along the whole length of the ceiling. This transformer was of 150 kilowatt capacity with a capacity of 300 kilowatt for a minute or more. With it the voltage could be steadily raised from 3000 to 30,000 volts.

Three direct current machines were used to take care of the load in the immediate center of the city. The balance of the load, with the exception of two lines, one northwest and the other southeast of the city, which were provided for by two small direct current steam stations, was taken care of by five substations located at various advantageous points throughout Baltimore. Current was transmitted to the substations from the Pratt Street Generating Station at 13,200 volts by means of fo~~u~~rty miles of No. 0000, 3-conductor, and thirteen miles of No. 0, 3- conductor, paper insula-

ted, lead encased copper cable.

The proceeding material concerning the equipment, construction and methods of operation of the Pratt Street Power Plant clearly shows the extent to which the United Railways & Electric Company went to obtain an efficient and economical power supply for the city of Baltimore. This power plant truly represented a remarkable advancement in the engineering world.

POWER PROGRESSION.

The power system of the United Railways & Electric Company was neither built overnight nor was this system completed with the erection of the Pratt Street Power Plant. Instead, this plan required years to complete and consisted of transfering all generating apparatus of the small stations to the central power plant.

In 1904, the transit system consisted of the following power plants and their corresponding capacities: Pratt Street, 15,600 kilowatts; Falls Road, 2,250 kilowatts; Light Street, 2000 kilowatts; Bear Creek, 675 kilowatts; Carey Street, 600 kilowatts; Gilmore Street, 550 kilowatts; and Back River, 424 kilowatts. The power system at this time represented a total capacity of 23,849 kilowatts. The capacities of substations then in use were: Druid Hill, 4,500 kilowatts; Dugan's Wharf on Pratt Street, 3,000 kilowatts; and Nunnery Lane, 1,500 kilowatts.

With the completion of the Northern substation, and the transfer of two additional units to the Pratt Street Power Plant from abandoned plants, it became possible to shut down the plants at Gilmore Street, Light Street, Bear Creek, Carey Street and Preston Street, Each of these plants having been generating electricity at a cost greatly in excess of that at Pratt Street.

In 1907 the Bay Shore power house was constructed to supply light and power for Bay Shore Park. It having been found more satisfactory to build the Bay Shore Station, using equipment that was idle, than to run feeders from the Eastern Substation. This was the last power plant built by the United Railways & Electric Company, and its 1,175 kilowatt capacity was overshadowed by the 25,000 kilowatt capacity of the Pratt Street Power Plant.

In 1908, due to damage by fire, it was found necessary to abandon the Falls Road Plant. Cables were run from this plant to the Northern Substation where the additional load was taken care of by increasing the output at Pratt Street.

The year 1909 found the Pratt Street Power Plant busy with activity and in its golden era. The capacity of the plant had now reached a total of 39,400 kilowatts and it was the only power plant in operation, with the exception of Bay Shore. A plant at the Owings Mills Station was kept in operating condition, but was not used.

Thus, in less than ten years the power supply system of the United Railways & Electric Company had changed from an extravagant system of numerous small operating plants to a modern centralized power combination. At this time, plans were made for supplying additional power from the Mc Call Ferry Plant of the Pennsylvania Water & Power Company by running high tension cables from this company to the Pratt Street Station. The first contract for additional power was signed in 1911. In that year the United Co. purchased 45,175,000 kilowatt hours from the Pennsylvania Company, and generated 63,003,722 kilowatt hours at their Pratt Street Plant. This amount of additional power being supplied was gradually increased until the Pratt Street Station was used solely for emergency service at power failures of the Pennsylvania Water & Power Company.

TRANSFER OF OWNERSHIP.

On January 12, 1921 the United Railways & Electric Company, the Consolidated Gas, Electric Light & Power Company of Baltimore and the Pennsylvania Water & Power Company entered into an

agreement covering the sale of the Pratt Street Power Plant to the Consolidated Company and the purchase of power from this company by the Railways Company. This agreement provided for a payment of four million dollars for the power station and for increased power supply by the Pennsylvania Company to the Consolidated Company as required. The Railway Company in the future will devote its time exclusively to traction operations. Under a perpetual contract, with flexible terms adjusted to meet changing conditions, it will purchase all electrical energy needed for the operation of its lines during the next fifty years from the Consolidated Company. Thus, the United Railways & Electric Company left the generation of electricity to a company specializing in electric power supply.

The main idea of this purchase and contract was, of course, to gain the many advantages and economies incident to the consolidation of all electric generating plants under a single management; The savings possible under such a unified system of power generation were very substantial, for instance; At that time there was suffi- lc. cient steam generating equipment at Westport, the main generating plant of the Gas & Electric Company, to supply all necessary steam generation for the railway company as well as its own load for several years to come, when used in connection with all the hydroelectric energy sent to Baltimore from the Susquehanna River. This situation made possible the shutting down of the Pratt Street Station for some time, which resulted in large economies from the saving in labor at one point and the saving in operating cost due to the larger and more efficient units available at Westport.

As in the case of all sound business transactions, this agreement was favorable for all parties concerned. The employees of the Consolidated Gas & Electric Company felt gratified that their company was rapidly growing as a wholesale power manufacturing concern, while the United Railways & Electric Company was gratified that their resources and opportunities to extend the railway system were greatly increased.

MODERN IMPROVEMENTS.

For several years the Pratt Street Power Plant was idle, but later on it was again used to supply power to the United Railways & Electric Company. The electrical equipment located at Pratt Street was found inadequate to handle the energy required by the Railways Company. As it was necessary to provide new switching equipment, it was also necessary to provide a suitable building to properly arrange and house this equipment in a most efficient manner. For this reason a new switch house was constructed.

The new switch house consisted of a five story steel and concrete building, constructed just inside the old Engine Room No. 1 and along its west wall. The west wall of the old building was used as part of the new structure, while a new east wall, new floors and a roof was required. The window and door openings were altered to meet new conditions; some were bricked up while in others glass was replaced with sheet copper and permanent louvres, installed for ventilating purposes. The basement of the new building was approximately at the same level as the street pavement along Pratt Street, so a new doorway was provided in the north wall near the northwest corner of the building. This new doorway was

treated to architecturally match the old doorway near the east wall. The basement consisted principally of cable trenches and facilities for the incoming and outgoing high tension cables.

The main floor and first gallery contained concrete bus structures of similar design to those in the latest substations of the company. The second or reactance floor, directly above the first gallery, contains the reactors, while the top floor was fitted out as an operating room, operator's office and relay repair department. The building also has an electric elevator located at the north end of the structure and runs from the basement to the top floor.

In order to obtain safety in switching there was provided new high powered switches with a rupturing capacity of 20,000 amperes. This was a great improvement over the old type "C" switches which had a rupturing capacity of only 2,000 amperes, while the short circuit currents that may be expected on the 13,200 volt system is approximately 20,000 amperes. Reactance coils were also supplied on each feeder from Highlandtown and Westport, which limited the short circuit current on any of these feeders to 10,000 amperes or less. This meant that no matter what happened to one of these cables the oil switches could easily open the circuit doing something less than one-half of the work for which they were guaranteed.

Considerable study was also given to the proper handling of the cables from the street duct lines on Pratt Street into the basement of the new switch house. With the old arrangement there had been much congestion, so additional lines were built and many of the old cables were rerouted. The cables were completely segre-

One of the main control panels located in the new switch house. The instruments at the top of the panel are ammeters while those at the bottom are overload time relays. The bus bars, which are controlled by this panel, are three phase, 13,200 volts and run to various substations throughout the city.

The generator panel containing instruments that read kilowatts, kilowatt-hours, power factor and field current. All instruments on the main panel and the generator panel were made by Westinghouse.

gated into three groups belonging to the United Railways & Electric Company, Pennsylvania Water & Power Company and the Baltimore Consolidated Gas Electric Light & Power Company.

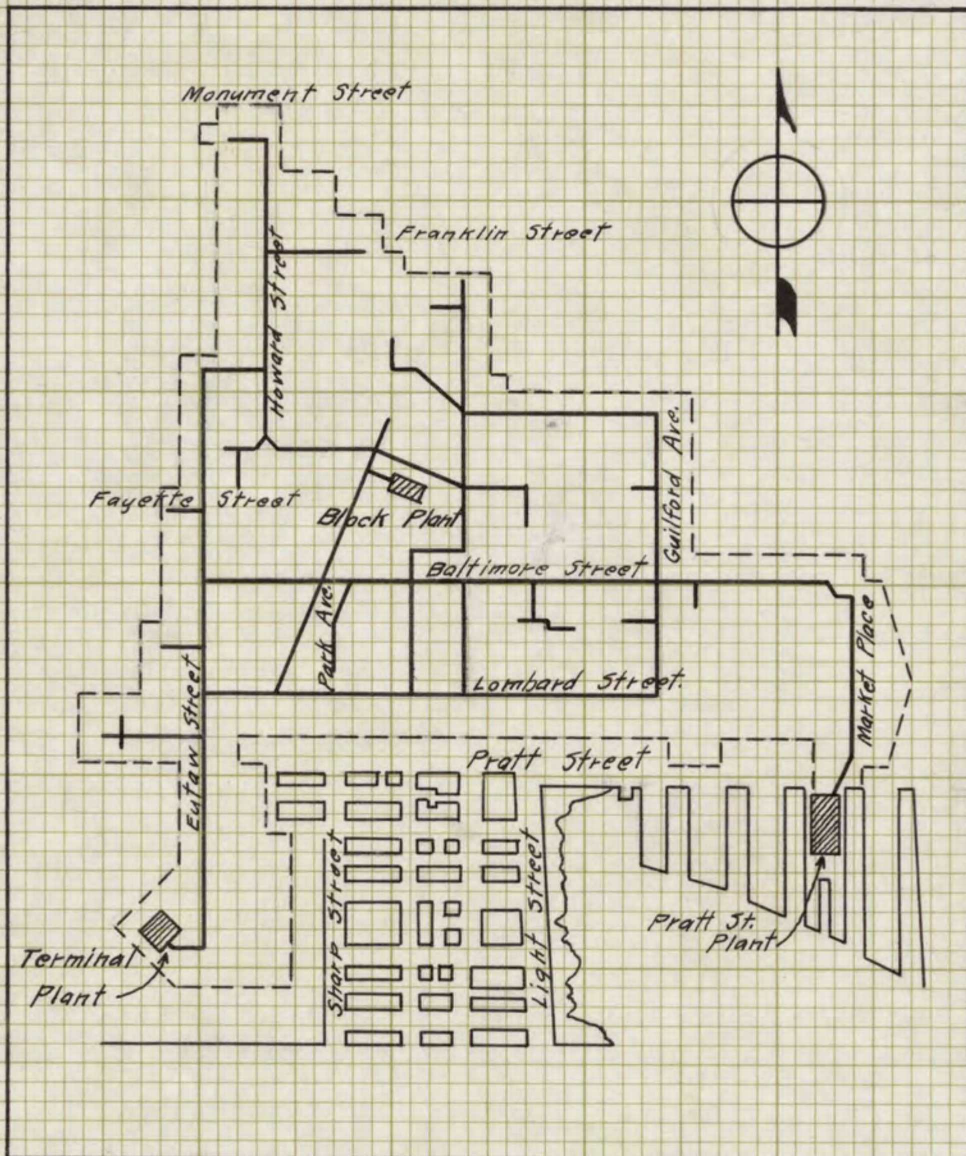
Upon completion of the new switch house in 1927, all equipment in the old switch house was abandoned. This space was found to make an ideal record store room which was badly needed. Therefore, the store room was relocated from Spring Gardens and now occupies the old Engine Room No. 1.

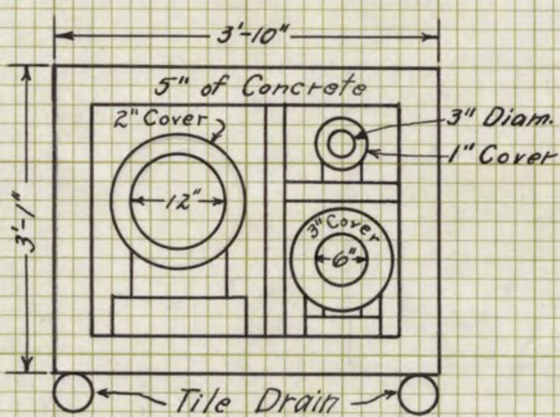
In 1927, a large section of Baltimore was being served by the District Steam Heating System. This system consisted of supplying steam to office buildings, department stores and restaurants, for heating purposes. In 1928 the Consolidated Gas Electric Light & Power Company took over the district steam operations, and since that time five hundred privately owned boiler plants have been displaced by this clean and efficient heating service.

As shown by the diagrams on page fourteen this system is supplied by three steam plants, namely, the Pratt Street Power Plant which supplies high pressure steam, the Terminal Plant which supplies low pressure steam, and the Block Plant which receives the return condensed steam. There is also shown on page fourteen the cross-section of one of the main conduits used to carry the steam from these plants to various advantageous points in the downtown section of Baltimore.

Today one finds the old Pratt Street Power Plant still serving Baltimore to the best of its advantage. Power in the form of steam being used for heat and comfort while electricity is provided for the rapid transportation of the people throughout Baltimore.

THE DISTRICT STEAM HEATING SYSTEM.





CROSS-SECTION OF CONDUIT.

<u>Legend</u>

<u>Main Pipe Lines</u>
<u>Area Supplied</u>
<u>Steam Stations</u>

12" Pipe for Low Pressure
6" Pipe for High Pressure
3" Pipe for Return

CONCLUSION.

The wholesale adoption of electric power by the manufacturing and transportation companies of America, and their use of central station equipment, read like the story of the automobile. In fact, these two great services of mankind, electrical energy and gasoline vehicle, have experienced much the same phenominal growth, and yet a growth which has so entwined these forces into the very economic being of the nation that they will endure as long as the nation itself.

The power system set up in Baltimore by the United Railways & Electric Co., known today as the Baltimore Transit Co., and the Baltimore Consolidated Gas Electric Light & Power Co. would have been a credit to any community and it is without a doubt one of the most important factors in the growth of that city. Since the Pratt Street Power Plant was the very soul of this power system, it may be said that this power station was one of the greatest steps ever made by Baltimore to attain fame and glory as a modern American city.

Well known to the average layman are facts concerning the electric lights in his home, the street car he rides to work on, and possibly the steam that heats his office, but so seldom does he realize just exactly what is behind all these wonderful conveniences. The answer is, of course, the power plant. Perhaps it will take some dreary morning when the current is shut off to awaken the public to the full realization of the important part that the modern power plant plays in their lives. Then, when Mr. John Q. Public awakes to find he is without electric lights, has to walk to his place of employment and work in a cold office,

will he finally realize that there is something quite important about a main power station.

I mention this because I found so many well educated persons, living in Baltimore, had not even heard of the Pratt Street Power Plant.

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